Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/36
FRANCE
February 1964
Original: FRENCH

Confidential until official release during Conference

Abstract

DEVELOPMENTS IN NATURAL URANIUM-GRAPHITE REACTORS

by MM. M. BOURGEOIS - Chef du Département des Etudes de Piles - CEA
M. SAITCEVSKY - Chef du Service d'Etudes Générales Nucléaires EDF

(Commissariat à l'Energie Atomique, France)

The French natural uranium-graphite power-reactor programme has been developing - from EDF 1 to EDF 4 - in the direction of an increase of the unit power of the installations, of the specific and volume powers, and of an improvement in the operational security conditions. The high power of EDF 4 (500 MWe) and the integration of the primary circuit into the reactor vessel, which is itself made of pre-stressed concrete, make it possible to make the most of the annular fuel elements already in use in EDF 1, and to arrive thus at a very satisfactory solution.

The use of an internally cooled fuel element (an annular element) has led to a further step forward : it now becomes possible to increase the pressure of the cooling gas without danger of causing creep in the uranium tube. The use of a pre-stressed concrete vessel makes this pressure increase possible, and the integration of the primary circuit avoids the risk of a rapid depressurization which would be in this case a major danger.

This report deals with the main problems presented by this new type of nuclear power station, and gives the main lives of research and studies now being carried out in France.

- Neutronic and thermal research has made it possible to consider using large size fuel elements (internal diameter = 77 mm, external diameter = 95 mm) while still using natural uranium.

Translation provided by courtesy of the submitting Government

- The problems connected with the production of these elements and with their in pile behaviour are the subject of a large programme, both out of pile and in power reactors (EDF 2) and test reactors (Pégase).

- The increase in the size of the element leads to a large lattice pitch (35 to 40 cm). This makes it possible to consider having one charging aperture per channel or for a small number of channels, whether the charge machine be inside or outside the pressure vessel.

In conclusion are given the main characteristics of a project for a 500 MWe power station using such a fuel element. In particular this project is compared to EDF 4 in order to show the advantages resulting from such developments in gas-graphite natural metallic uranium reactor systems ; these are : a doubling of the specific and volume powers, and a three-fold reduction in the number of channels.

The research now under way will make it possible to calculate the reduction in capital costs which will result from these important technical advances.